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Quarterly Report

No. 6

LIFAC Sorbent Injection Desulfurization Demonstration Project

Presented By

LIFAC North America

A Joint Venture Between

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Presented To

U.S. Department of Energy

Pittsburgh Energy Technology Center
Pittsburgh, Pennsylvania 15236

January - March 1992

LIFAC SORBENT INJECTION
DESULFURIZATION DEMONSTRATION PROJECT

QUARTERLY REPORT NO. 6
JANUARY - MARCH 1992

Submitted to

U. S. DEPARTMENT OF ENERGY

by

LIFAC NORTH AMERICA

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TABLE OF CONTENTS

INTRODUCTION

In December 1990, the U.S. Department of Energy selected 13 projects for funding under the Federal Clean Coal Technology Program (Round III). One of the projects selected was the project sponsored by LIFAC North America, (LIFAC NA), titled "LIFAC Sorbent Injection Desulfurization Demonstration Project." The host site for this $22 million, three-phase project is Richmond Power and Light's Whitewater Valley Unit No. 2 in Richmond, Indiana. The LIFAC technology uses upper-furnace limestone injection with patented humidification of the flue gas to remove 75-85% of the sulfur dioxide (SO_2) in the flue gas.

In November 1990, after a ten (10) month negotiation period, LIFAC NA and the U.S. DOE entered into a Cooperative Agreement for the design, construction, and demonstration of the LIFAC system. This report is the sixth Technical Progress Report covering the period January 1, 1992 through the end of March 1992. Due to the power plant's planned outage schedule, and the time needed for engineering, design and procurement of critical equipment, DOE and LIFAC NA agreed to execute the Design Phase of the project in August 1990, with DOE funding contingent upon final signing of the Cooperative Agreement.

BACKGROUND

Project Team

The LIFAC demonstration at Whitewater Valley Unit No. 2 is being conducted by LIFAC North America, a joint venture partnership between:

- ICF Kaiser Engineers - A U.S. company based in Oakland, California, and a subsidiary of ICF International (ICF) based in Fairfax, Virginia.

- Tampella Power Corp. - A U.S. subsidiary of a large diversified international company, Tampella Corp., based in Tampere, Finland and the original developer of the LIFAC technology.

LIFAC NA is responsible for the overall administration of the project and for providing the 50 percent matching funds. Except for project administration, however, most of the actual work is being performed by the two parent firms under service agreements with LIFAC NA. Both parent firms work closely with Richmond Power and Light and the other project team members, including ICF Resources, the Electric Power Research Institute (EPRI), Indiana Corporation for Science and Technology (ICS&T), and Black Beauty Coal Company. LIFAC NA is having ICF Kaiser Engineers manage the demonstration project out of its Pittsburgh office, which provides excellent access to the DOE representatives of the Pittsburgh Energy Technology Center. Figure 1 shows the management structure being used throughout the three phases of the project.

LIFAC NA administers the project through a Management Committee that decides the overall policies, budgets, and schedules. All funding sources, invoicing, and information flows to LIFAC NA where the managing partners ensure that the project, funding and expenditures are consistent and in-line with the established policies, budgets, schedules and procedures.

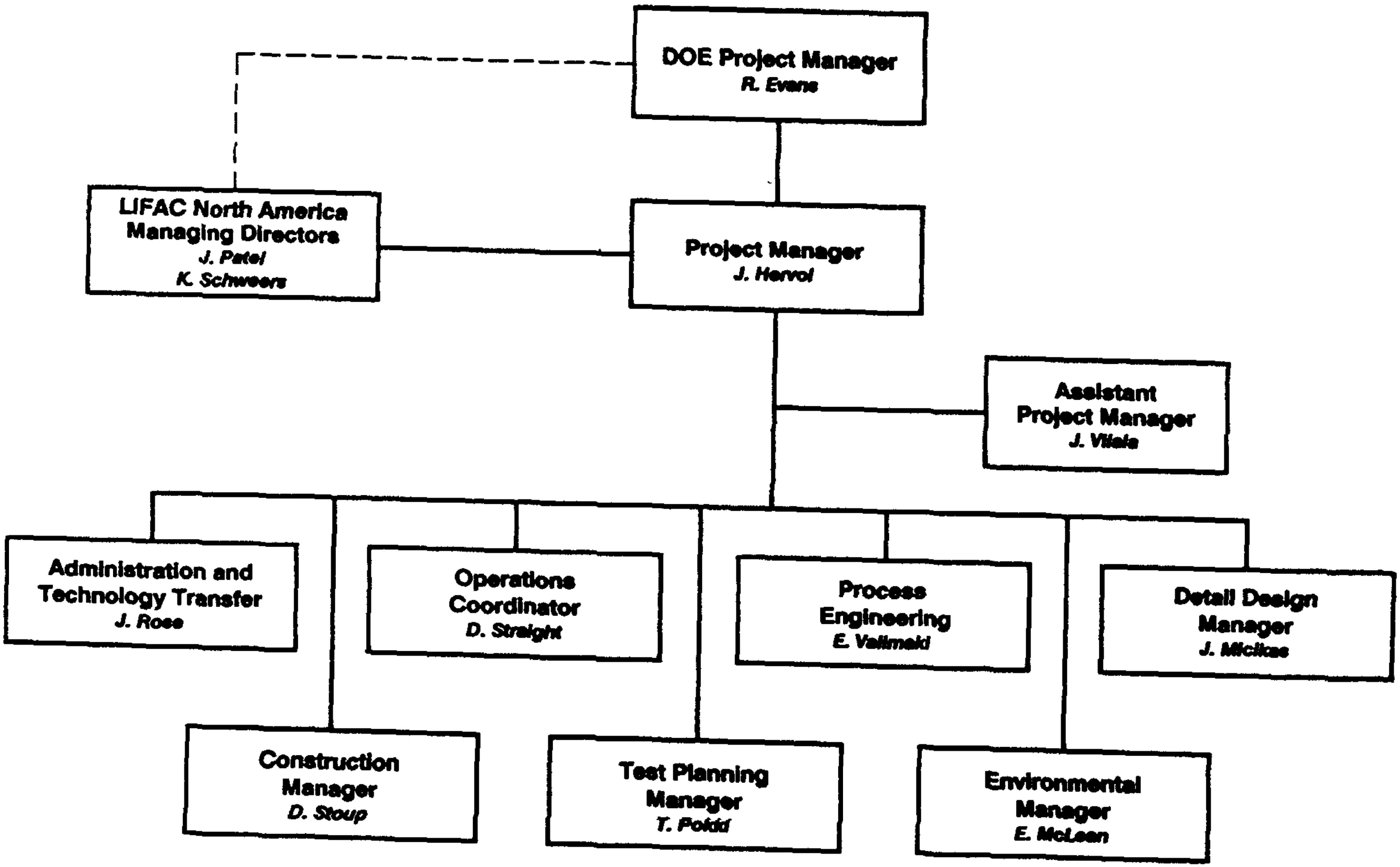
Process Development

In 1983, Finland enacted acid rain legislation which applied limits on SO_2 emissions sufficient to require that flue gas desulfurization systems have the capability to remove about eighty percent (80%) of the sulfur dioxide in the flue gas. This level could be met by conventional scrubbers, but could not be met by then available sorbent injection technology. Therefore, Tampella began developing an alternative system which resulted in the LIFAC process.

Initially, development included laboratory-scale and pilot-plant tests. Full-scale limestone injection tests were conducted at Tampella's Inkeroinen facility, a 160 MW coal-fired boiler using high-ash, low-sulfur Polish coal. At Ca:S ratios of 3:1, sulfur removal was less than 50%. Better results could have been attained using lime, but was rejected because the cost of lime is much higher than that of limestone.

In-house investigations by Tampella led to an alternative approach involving humidification in a separate vertical chamber which became known as the LIFAC Process. In cooperation with Pohjolan Voima Oy, a Finnish utility, Tampella installed a full-scale limestone injection facility on

Project Organization



a 220 MW coal-fired boiler located at Kristiinankaupunki. At this facility, a slipstream (5000 SCFM) containing the calcined limestone was used to test a small-scale activation reactor (2.5 MW) in which the gas was humidified. Reactor residence times of 3 to 12 seconds resulted in SO_2 removal rates up to 84%. Additional LIFAC pilot-scale tests were conducted at the 8 MW (thermal) level at the Neste Kulloo combustion laboratory to develop the relationships between the important operating and design parameters. Polish low-sulfur coal was burned to achieve 84% SO_2 removal.

In 1986, full-scale testing of LIFAC was conducted at Imatran Voima's Inkoo power plant on a 250 MW utility boiler. An activation chamber was built to treat a flue gas stream representing about 70 MW. Even though the boiler was 250 MW, the 70 MW stream represented about one-half of the flue gas feeding one of the plant's two EPS's (i.e., each ESP receives a 125 MW gas stream). This boiler used a 1.5% sulfur coal and sulfur removal was initially 61%. By late 1987, SO_2 removal rates had improved to 76%. In 1988, a LIFAC activation reactor was added to treat an additional 125 MW -- i.e., an entire flue gas/ESP stream-worth of flue gas from this same boiler. This newer activation reactor is achieving 75-80% SO_2 removal with Ca:S ratios between 2:1 and 2.5:1. In 1988, the first tests using high-sulfur U.S. coals were run at the pilot scale at the Neste Kulloo Research Center, using a Pittsburgh No. 8 coal containing 3% sulfur. SO_2 removal rates of 77% were achieved at a Ca:S ratio of 2:1.

This LIFAC demonstration project will be conducted on a 60 MW boiler burning high-sulfur U.S. coals to demonstrate the commercial application of the LIFAC process to U.S. utilities.

Process Description

LIFAC combines upper-furnace limestone injection followed by post-furnace humidification in an activation reactor located between the air preheater and the ESP. The process produces a dry and stable waste product that is partially removed from the bottom of the activation reactor and partially removed at the ESP.

Finely pulverized limestone is pneumatically conveyed and injected into the upper part of the boiler. Since the temperatures at the point of injection are in the range of 1800-2000° F, the limestone ($CaCO_3$) decomposes to form lime (CaO). As the lime passes through the furnace, initial desulfurization reactions take place. A portion of the SO_2 reacts with the CaO to form calcium sulfite ($CaSO_3$), part of which then oxidizes to form calcium sulfate ($CaSO_4$). Essentially all of the sulfur trioxide (SO_3) reacts with the CaO to form $CaSO_4$.

The flue gas and unreacted lime exit the boiler and pass through the air preheater. On leaving the air preheater, the gas/lime mixture is directed to the patented LIFAC activation reactor. In the reactor, additional sulfur dioxide capture occurs after the flue gas is humidified with a water spray. Humidification converts lime (CaO) to hydrated lime, $Ca(OH)_2$, which enhances further SO_2 removal. The activation reactor is designed to allow time for effective humidification of the flue gas, activation of the lime, and reaction of the SO_2 with the sorbent. All the water droplets evaporate before the flue gas leaves the activation reactor. The activation reactor is also designed specifically to minimize the potential for solids build-up on the walls of the chamber. The net effect is that at a Ca:S ratio in the range of 2:1 to 2.5:1, 70-80% of the SO_2 is removed from the flue gas.

The flue gas leaving the activation reactor then enters the existing ESP where the spent sorbent and fly ash are removed from the flue gas and sent to the disposal facilities. ESP effectiveness is also enhanced by the humidification of the flue gas. The solids collected by the ESP consist of fly ash, $CaCO_3$, $Ca(OH)_2$, CaO, $CaSO_4$, and $CaSO_3$. To improve utilization of the calcium, and increase SO_2 reduction to between 75 and 85%, a portion of the spent sorbent collected in the bottom of the activation reactor and/or in the ESP hoppers is recycled back into the ductwork just ahead of the activation reactor.

Process Advantages

The LIFAC technology has similarities to other sorbent injection technologies using humidification, but employs a unique patented vertical reaction chamber located down-stream of the boiler to facilitate and control the sulfur capture and other chemical reactions. This chamber improves the overall reaction efficiency enough to allow the use of pulverized limestone rather than more expensive reagents such as lime which are often used to increase the efficiency of other sorbent injection processes.

Sorbent injection is a potentially important alternative to conventional wet lime and limestone scrubbing, and this project is another effort to test alternative sorbent injection approaches. In comparison to wet systems, LIFAC, with recirculation of the sorbent, removes less sulfur dioxide - 75-85% relative to 90% or greater for conventional scrubbers - and requires more reagent material. However, if the demonstration is successful, LIFAC will offer these important advantages over wet scrubbing systems:

- LIFAC is relatively easy to retrofit to an existing boiler and requires less area than conventional wet FGD systems.

- LIFAC is less expensive to install than conventional wet FGD processes.

- LIFAC's overall costs measured on a dollar-per-ton SO_2 removed basis are less, an important advantage in a regulatory regime with trading of emission allocations.

- LIFAC produces a dry, readily disposable waste by-product versus a wet product.

- LIFAC is relatively simple to operate.

HOST SITE DESCRIPTION

The site for the LIFAC demonstration is Richmond Power and Light's Whitewater Valley 2 pulverized coal-fired power station (60 MW), located in Richmond, Indiana. Whitewater Valley 2, which began service in 1971, is a Combustion Engineering tangentially-fired boiler which uses high-sulfur bituminous coal from Western Indiana. Actual power generation produced by the unit approaches 65 megawatts. As such, it is one of the smallest existing, tangentially-fired units in the United States. The furnace is 26-feet, 11-inches deep and 24-feet, 8-inches wide. It has a primary and secondary superheater. Tube sizes and spacings are designed to achieve the highest possible heat-transfer rates with the least potential for gas-side fouling. The unit also has an inherent low draft-loss characteristic because of the lack of gas turns. At full load 540,000 lbs/hr. of steam are generated. The heat input at rated capacity is 651 x 10^6 Btu per hour. The design superheater outlet pressure and temperature are 1320 psi at 955°F. The unit has a horizontal shaft basket-type air preheater. The temperature leaving the economizer is about 645°F, while the stack gas temperature is about 316°F. The balanced-draft unit has 12 burners.

In 1980 the unit was fitted and fully optimized with a state-of-the-art Low-NO_x Concentric Firing System (LNCFS). The LNCFS represents a very cost effective means of reducing NO_x emissions in comparison with other retrofit possibilities. The system works on the principal of directing secondary air along the sides of the furnace and creating a fuel rich zone in the center of the furnace. With the LNCFS, the excess air can be maintained below 20 percent. Additionally, the installation reduces ash accumulation on the furnace walls increasing heat absorption and reducing attemperation requirements. With the LNCFS, each corner of the furnace has a tangential windbox consisting of three coal compartments and four auxiliary air compartments. At full load with all three 593 RB pulverizers operating, primary transport air from the pulverizers amounts to 23 percent of the total combustion air. Pulverizer capacity is 26,400 lbs/hr. with 52 grind coal and 70 percent minus 200 mesh.

Whitewater Valley 2 has a Lodge Cottrell cold side precipitator which was erected with the boiler. The precipitator treats 227,000 actual cubic feet per minute of 316°F flue gas with 45,000 square feet of collection area. The unit has two mechanical fields and four electrical fields and achieves 99 percent removal efficiency (from 3.9 gr/ft^3 to 0.04 gr/ft^3). The ESP performance was optimized by Lodge Cottrell when Richmond Power and Light purchased new controllers in 1985.

Whitewater Valley Unit 2's overall efficiency of 87.47 percent at full load has shown little variation over the years. The unit's average heat rate is 10,280 Btu/Kwh. At 60 percent of full load, the unit's efficiency increases to 88.17 percent. The unit uses approximately 0.935 pounds of coal per Kwh and generates 8.51 pounds of steam per Kwh.

The primary emissions monitored at the station are SO_2 and opacity. SO_2 emissions are calculated based on the coal analysis and are limited to 6 lbs/MBtu. Opacity is monitored using an in-situ meter at the stack and is currently limited to 40 percent. Current SO_2 emissions for the unit are approximately 4 lbs/MBtu, while opacity at full load ranges from 15 to 20 percent. Opacity at low load (40MW) ranges from 3 to 5 percent. Limited testing was conducted in November of 1986 for NO_x emissions. Results from the test work indicated that NO_x emissions averaged 0.65 lbs/MBtu.

Whitewater Valley 2 has several important qualities as a LIFAC demonstration site. One of these is that Whitewater Valley 2 was the site of a prior joint EPA/EPRI demonstration of LIMB sorbent injection technology. Much of the sorbent injection equipment remains on site and will be used in the LIFAC demonstration, if possible. Another advantage of the site is that Whitewater Valley 2 is a challenging candidate for a retrofit due to the cramped conditions at the site. The plant is thus typical of many U.S. power plants which are potential sites for application of LIFAC. In addition, the Whitewater Valley 2 boiler is small relative to its capacity; hence, it has high-temperature profiles relative to other boilers. This situation will require sorbent injection at higher points in the furnace in order to prevent deadburning of the reagent and may decrease residence times needed for sulfur removal. Whitewater Valley 2 will show LIFAC's performance under operational conditions most typical of U.S. power plants. The project will demonstrate LIFAC on high-sulfur U.S. coals and is a logical extension of the Finnish demonstration work and important for LIFAC's commercial success in the U.S.

PROJECT SCHEDULE

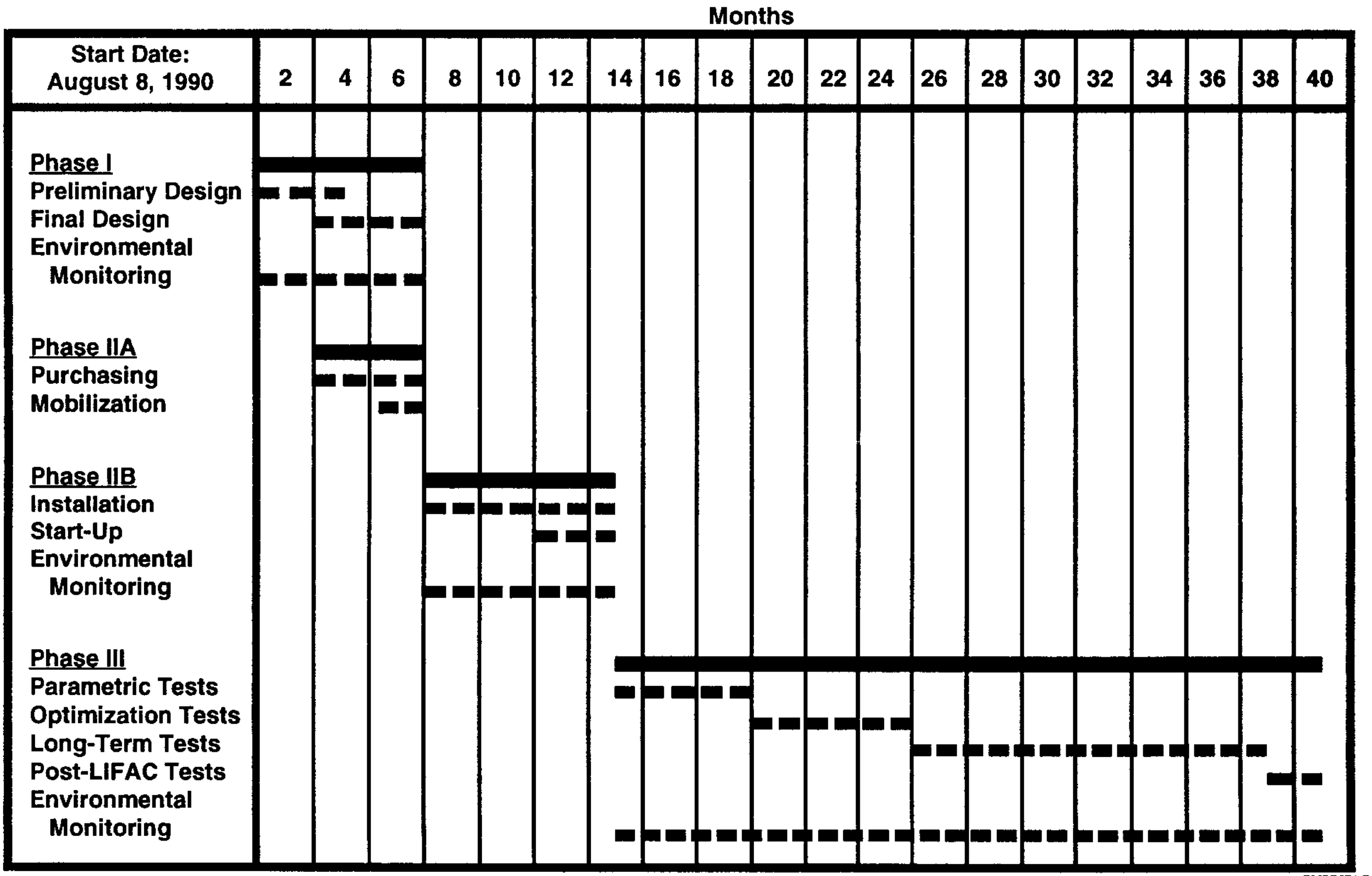
To demonstrate the technical viability of the LIFAC process to economically reduce sulfur emissions from the Whitewater Valley Unit No. 2, LIFAC NA is conducting a three-phase project.

Phase I: **Design**
Phase IIA: **Long Lead Procurement**
Phase IIB: **Construction**
Phase III: **Operations**

Except Phase IIA, each phase is comprised of three (3) tasks, a management and administration task, a technical task and an environmental task. The design phase began on August 8, 1990 and was scheduled to last six (6) months. Phase IIA, long lead procurement, overlaps the design phase and was expected to require about four (4) months to complete. The construction phase was then to continue for another seven (7) months, while the operations phase was scheduled to last about twenty-six (26) months. Figure 2 shows the original estimated project schedule which is based on a August 8, 1990 start date and a planned outage of Whitewater Valley 2 during March 1991.

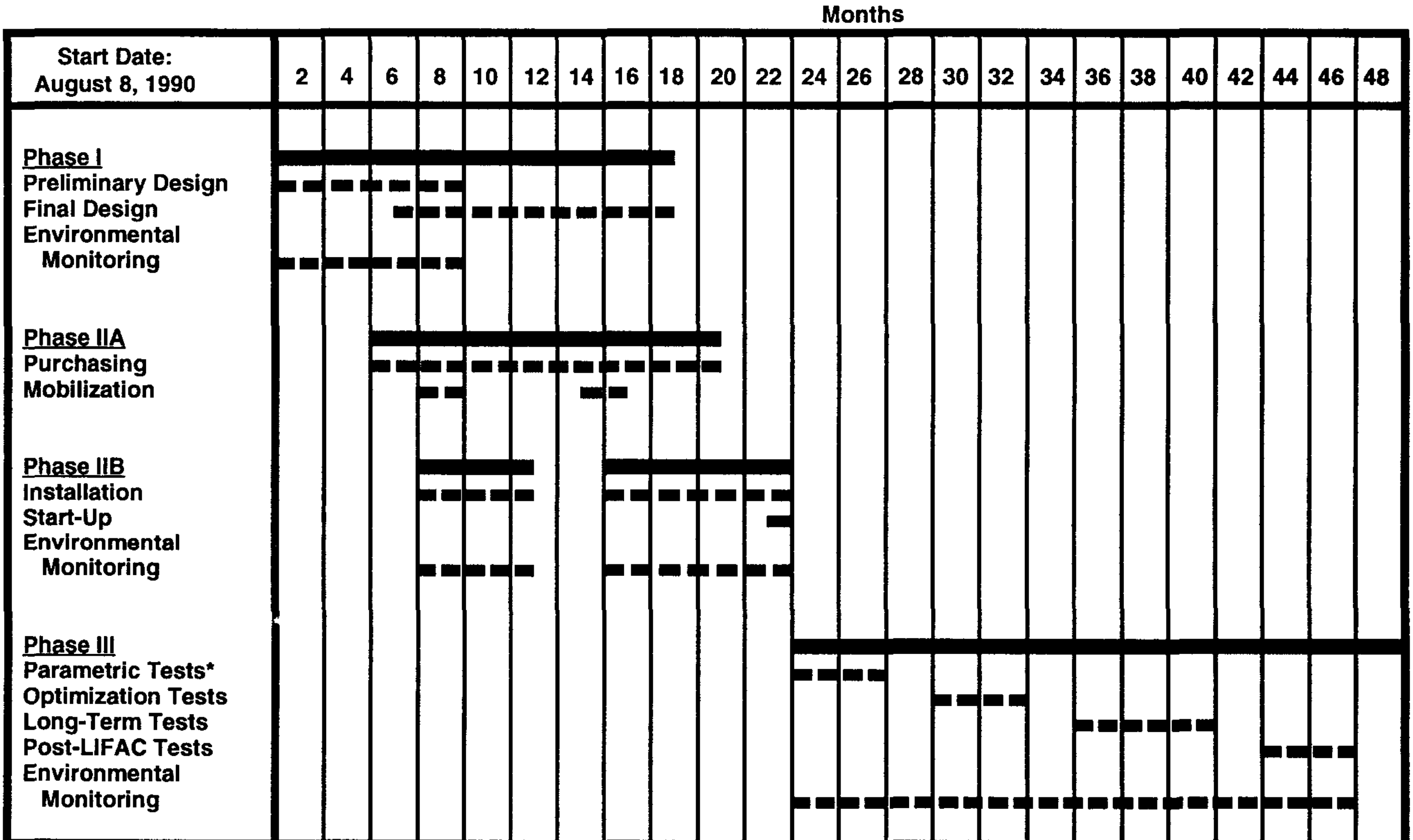
It is during this outage that all the tie-ins and modifications to existing Unit No. 2 equipment were made. This required that the construction phase begin in early February, 1991 -- construction and start-up were to be completed by the end of August 1991. Operations and testing were to begin in September 1991 and continue for 26 months. However, during previous reporting periods, the project encountered delays in receiving its construction permit. These delays, along with some design changes, and an approved expansion in project scope required that the Design Phase be extended by about eleven months. Therefore, construction and start-up will not be completed until early June 1992. This represents a nine-month extension in the overall schedule. Figure 3 shows the revised project schedule. Total project duration will now be 48 months.

LIFAC Demonstration
Original Project Schedule



LIFAC Demonstration

Revised Project Schedule



* Includes baseline testing.

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TECHNICAL PROGRESS

The work performed during this period (January - March 1992) was consistent with the revised Statement of Work (Scope Increase) and the approved schedule change contained in the Cooperative Agreement. During this period, emphasis was placed on all four tasks in the Construction Phase, including Project Management, Long Lead Procurement, Installation and Start-up, and Environmental Monitoring. Following is a summary of the work performed under these tasks.

Project Management (WBS 1.2.1B)

During the January through March period, management efforts and achievements included:

- **LIFAC Management Committee Meeting** - The LIFAC management committee held a formal management committee meeting on January 23, 1992 at the Richmond Power and Light offices in Richmond, Indiana. The agenda of this meeting included:

  - The project managers of ICF Kaiser Engineers and Tampella Power reported that DOE approved LIFAC NA's request for an increase in scope, budget and co-funding. The request from DOE related to the recycling of wastes, ESP upgrade, more durable materials of construction, etc. As a result, the managers intended to begin full construction at the site including the activation chamber in the immediate future, and that they required additional authorization to commit funds.

  - During the meeting, the management committee authorized additional financial commitments by ICF Kaiser Engineers up to the limit contained in the new Period I budget. Previously, the management committee limited ICF KE's authorization pending the results of the DOE review of the scope/budget request.

  - The committee heard reports on regulatory and permitting developments.

- The committee also heard reports related to: (1) schedule and budget, (2) fulfillment of the DOE Cooperative Agreement including the numerous reports required at the end of Budget Period I (Project Evaluation Plan, Test Plan, Start-up Plan, Continuation Request, Design Report, etc.), and (3) interfaces with co-funders.

- The committee heard reports on relations with the host site utility including such specific issues as regulatory developments and waste disposal. Immediately after the meeting, the committee met with the management of RP&L.

• **Joint LIFAC NA/DOE Cooperation** - For this period, LIFAC NA successfully implemented the Cooperative Agreement's management, administrative and technical provisions including DOE reporting and administrative requirements:

  - LIFAC NA provided to DOE required financial, project and cost reports including: (1) monthly technical progress, (2) cost management, and (3) federal assistance management summary reports. These reports met all DOE specifications related to committed costs.

  - LIFAC NA sent invoices to DOE during the period consistent with DOE requirements that the project report invoiced costs on a phase-by-phase basis.

• **Regulatory** - Overall, in the previous period, the project made significant progress resolving regulatory problems (e.g. receipt of the construction permit). However, due to the importance of this area, the LIFAC Management Committee continued to manage/oversee, and in some cases, directly participate (e.g. meeting with regulatory attorneys) in the permitting and approvals process. The environmental regulatory situation is summarized here:

  - At the beginning of this period, Indiana Department of Environmental Management (IDEM) responded to RP&L's variance request filed in the third quarter of 1991 which would increase particulate emission limit. RP&L needed to change its limit independent of the LIFAC process, but the utility included a clause into the request specifically addressing the LIFAC demonstration. Specifically, IDEM decided not to provide a variance, but wanted to provide a NAA (No Action Assurance).

In response, LIFAC NA instructed Kenneth Schweers and Jim Hervol to further pursue this matter. LIFAC NA and RP&L took several steps in this regard: (1) meetings with IDEM in Indianapolis, (2) meetings with regulatory attorneys, (3) provision of additional information about LIFAC's impact on TSP emissions supporting the variance request, (4) site visits by IDEM (during the quarterly review meeting), and (5) authorization to MES, an atmospheric modeling firm to conduct additional analysis of ambient impacts of LIFAC and Whitewater Valley Unit #2 emissions.

At the end of the quarter, IDEM agreed to provide a variance and all the parties conducted final negotiations with respect to the detailed provisions of the variance.

- During this period, IDEM provided LIFAC NA a letter stating that the project could dispose of LIFAC waste in landfills, and that subject to the conditions stated in LIFAC NA's submittal, that IDEM considered the waste as a special utility waste exempt from Hazardous classification. In the previous periods, ICF KE provided IDEM several submittals on the characteristics of the LIFAC waste product.

• **Funding Agreement** - LIFAC NA continued efforts to negotiate and finalize arrangements for participation/funding of other project participants:

  - Electric Power Research Institute - LIFAC NA project managers conferred with representatives of EPRI to discuss EPRI funding. More information on funding and technical assistance is expected in the next reporting period.

- Indiana Corporation for Science and Technology (CST) - LIFAC NA received $0.45 million during the previous period and expects to receive additional funding (approximately $0.35 million) during the next period.

- Black Beauty Coal Company - LIFAC NA believes that Black Beauty will provide most of the coal for the test program and replace the coal expected from Peabody Coal Company. LIFAC NA will continue to negotiate a contribution from Black Beauty towards the project.

- Southdown/Kosmos Cement Company - During the reporting period, Southdown made a proposal with respect to limestone supply and some contribution to the project. These negotiations are not likely to be successful, and hence, LIFAC NA will purchase limestone based on the currently scheduled competitive solicitation.

• **Technology Transfer Activities** - On March 27, 1992, LIFAC NA held a management committee meeting devoted entirely to technology transfer and marketing issues. At the meeting, LIFAC NA made several decisions with respect to: (1) attending and/or exhibiting at conferences during 1992, (2) brochure design and content, (3) meetings with individual utilities to discuss LIFAC and invite them to the demonstration plant, (4) the content of LIFAC offers to customers, (5) the role of LIFAC in the acid rain marketplace, (6) responses to recent EPRI flue gas desulfurization cost estimates, and (7) development of new marketing materials such as presentations.

  During the quarter, LIFAC NA and DOE jointly worked on several drafts of joint papers for presentation at the Pittsburgh Coal Conference to be held in Pittsburgh this fall, and for a conference to be held in Atlanta.

- **Scope Increase** - During this period, DOE formally approved an increase in project scope and its associated extension to the project schedule. The scope increase provides for the addition of enhanced design features into the LIFAC process at Richmond Power & Light. These improvements are expected to provide an additional 5 to 10 percentage point increase in SO_2 capture.

Long Lead Procurement (WBS 1.2.1A)

After DOE approved the scope increase, the last long lead items were procured for delivery to the project site. They include:

- Secondary air fan
- Boiler injection nozzles
- Sorbent recycle system

These items will be delivered to the site as quickly as possible in order to minimize any impacts on the overall construction schedule.

No additional work is required under this task.

Installation and Startup (WBS 1.2.2B)

ICF Kaiser Engineers used the services of four major subcontractors during this reporting period to continue erecting the LIFAC process. As during the last reporting period, work was concentrated in three areas:

- **Limestone Storage Area** - Work in this area progressed well. By the end of March, the following items were completed:

  - The limestone storage bin was hydrotested and accepted. The bin will be painted during the next reporting period.
  - The limestone storage building floor slab was poured, the building steel erection was completed and then insulated and sided. The building buildup roof was also completed.

  - All building HVAC equipment was received and about 50% installed.

- Approximately 75% of the piping in the limestone area was installed.
- All major electrical equipment (MCC, VFD, transformers, etc.) was received and installed.
- About 25% of the required instrumentation was received, but none was installed.
- The electrical subcontractor had installed about 80% of the exposed conduit and about 40% of the cable/wire. About 75% of the lighting fixtures were installed.

- **Boilerhouse/ESP Area** - Subcontractors made steady progress in this area with all structural activities being completed. Specifically, the following items were completed:

    - Support steel, grating and handrail were installed for the primary splitter and secondary air fan.
    - Support steel for the ESP area is on site but not installed due to a hold on mechanical equipment (recycle equipment).
    - The primary splitter and secondary splitters were installed.
    - The secondary air fan and humidification pump were installed.
    - Approximately 70% of the piping was installed but not tested.
    - All lighting fixtures were installed and energized.
    - The control room boiler panel was modified and the electrical equipment installed.
    - Approximately 50% of all cable/wire was pulled.

- **Reactor Area** - Although considerable progress was made in the reactor area, work did not progress as far as was expected. Subcontractors were able to complete the following activities:

    - Stair tower and reactor pile caps were poured along with all piers and grade walls for the reactor building.
    - The reactor electrical building masonry work was completed and roof steel installed.
    - Reactor support steel, stair tower steel and 95% of the reactor building steel was erected and detailed.
    - The crusher conveyors were set in place.

- The first two sections of reactor, "F" and "A" were erected.
- Reactor shell sections "B" and "C" were fabricated complete and ready to be insulated.
- Reactor shell sections "D" and "E" reached about 75% fabricated.
- All duct sections were received and about 90% were insulated and jacketed.
- Three sections of duct were set in place in the stair tower.
- Reactor shell section "A" was insulated and jacketed prior to setting; insulation of sections "B" and "C" was initiated.
- All mechanical equipment and HVAC units were received.
- Fabrication of air and water piping was started.
- All sub-surface grounding was installed along with embedded conduits for the reactor electrical building.

Environmental Monitoring (WBS 1.2.3B)

During this period, emphasis was placed on three activities:

- **Environmental Monitoring Plan** - Efforts were made to incorporate the latest set of comments received from DOE and to match the EMP with the testing sequence described in the draft Test Plan. The EMP will be submitted to DOE for final review and comment in mid April.

- **Refuse Disposal Permit** - After a long review process, IDEM granted the project permission to dispose of LIFAC ash in any approved sanitary landfill stating that LIFAC ash is considered a special utility waste exempt from hazardous classification.

- **Variance for Particulates** - Considerable efforts were placed on working with IDEM to develop a variance for particulate emissions during LIFAC operations. Drafts of the variance document were reviewed by LIFAC NA, RP&L, and IDEM in order to develop a document satisfactory to all parties. By the end of the reporting period, all parties had agreed in principal, although the formal variance would not be issued until operations begin.

FUTURE PLANS

During the next reporting period, emphasis will be placed on the following activities:

- Complete all field construction essential to operation of the LIFAC process at RP&L.
- Obtain the formal Variance from IDEM for particulate emissions
- Submit all required documents required for continuing into Budget Period II including:
    - EMP
    - Test Plan
    - Budget Period II Cost Plan
    - Budget Period I Evaluation Report
    - Budget Period II Evaluation Plan
    - Continuation Application

- Complete negotiations for coal and limestone delivery.
- Finalize cofunding agreements with Black Beauty Coal Co. and EPRI.
- Complete successful startup and commissioning of LIFAC.
- Begin baseline testing.
- Continue submitting the monthly cost and technical progress reports required under the Cooperative Agreement.